CLAIMS

1. A system for detecting and enhancing meteorological imagery of dust clouds comprising:

a collector for storing multispectral optical-spectrum imagery having multiple channels relating to different wavelengths across the visible, shortwave infrared, and thermal infrared portions of the optical spectrum,

a processor operatively coupled to said collector, wherein the processor receives the multispectral optical-spectrum imagery and processes the digital data by:

performing a numerical atmospheric correction for removal of molecular scatter within all of the visible-spectrum channels, based on radiative transfer calculations stored in pre-computed look-up tables and indexed as a function of solar and sensor geometry,

determining the pixel background for each pixel of the image by combining known earth location with a terrestrial database,

employing a background-dependent algorithm to compute the dust enhancement variable Δ,

means for displaying the multispectral imagery coupled to the processor, wherein the means for displaying the multispectral imagery comprises a red, blue and green color for displaying the visible light spectrum via a hue/saturation decomposed color technique.

2. The system of claim 1 whereby when a pixel is determined to have a water background, the processor calculates the log-scaled normalized difference (***D***) between the two channel reflectivities according to the relation:

$$\Delta = \frac{R_1 - R_2}{R_1 + R_2}$$

$$D = \log_{10}(\Delta),$$

byte-scaling this quantity over the range [-0.40, 0.15], where the bidirectional reflection function ($R_k \in [0, 1]$) at channel (k) is expressed in terms of channel radiance (I_k) as:

$$R_k = \frac{\pi I_k}{\mu_o F_{o,k}}$$

and μ_o and $F_{o,k}$ are the cosine of the solar zenith angle and band-weighted solar spectral flux, respectively.

3. The system of claim 2 wherein a first channel has a central wavelength in the shortwave infrared at approximately 0.83-0.88 μm, a second channel has a central wavelength in the indigo/blue part of the spectrum at approximately 0.41-0.46 μm, and a third channel has a central wavelength in the green part of the spectrum at approximately 0.50-0.55 μm.

4. A system for detecting atmospheric dust comprising:

a collector for storing multispectral optical-spectrum imagery having multiple channels relating to different wavelengths,

a processor operatively coupled to the collection means, wherein the processor receives the multispectral optical-spectrum imagery and processes the digital data by:

performing a numerical atmospheric correction for removal of molecular scatter within all of the visible-spectrum channels, based on radiative transfer calculations stored in pre-computed look-up tables and indexed as a function of solar and sensor geometry,

determining the pixel background for each pixel of the image by combining known earth location with a terrestrial database,

employing a background-dependent algorithm to compute the dust enhancement variable ***D***,

wherein when a pixel is determined to have a water background, $\boldsymbol{D}=\boldsymbol{D}_{\mathrm{wat}}$ and the processor calculates the log-scaled normalized difference ($\boldsymbol{D}_{\mathrm{wat}}$) between a second channel and a third channel reflectivities according to the relation:

$$\boldsymbol{D}_{\mathrm{wat}} = \log_{10}\left(\frac{R_1 - R_2}{R_1 + R_2}\right),$$

byte-scaling this quantity over the range [-0.40, 0.15], where the bidirectional reflection function ($R_k \in [0, 1]$) at channel (k) is expressed in terms of channel radiance (I_k) as:

$$R_k = \frac{\pi I_k}{\mu_o F_{o,k}}$$

and μ_o and $F_{o,k}$ are the cosine of the solar zenith angle and band-weighted solar spectral flux, respectively.